

2024 EDITION

# BITSTREAM

COMPUTER SCIENCE & ENGINEERING



## SNEAK PEEK Ace Your Space

Exam season? Worry not!  
These places got your back...

SEE INSIDE

## Serendipity

Good things are  
waiting to happen!

EXCLUSIVE SCOOP

## An Evening with Prof. Manas

Cool prof spills his mantras to  
academic and personal fulfillment

# C O N T E N T S TABLE OF



|  |    |
|--|----|
| Ace Your Space .....                               | 01 |
| An Ode to Trying .....                             | 02 |
| Serendipity : Meeting People by Chance .....       | 04 |
| Web3 : A Farce or the Future? .....                | 06 |
| An Evening with Prof. Manas Thakur .....           | 08 |
| Breached! .....                                    | 11 |
| Why do IIT UGs Do What They Do .....               | 14 |
| Unravelling PHD's : Aditya Kusupati .....          | 16 |
| The Startup Chronicles : Chitwan Saharia .....     | 18 |
| A Day With Prof. Puru! .....                       | 21 |
| A Chat with Shabnam Sahay .....                    | 22 |
| The Future is A.I. Right? .....                    | 24 |
| The Hitchhiker's Guide to Doing a POR Justice! ... | 26 |
| A Note from the Editor .....                       | 29 |
| The BitStream 23-24 Team .....                     | 30 |

# Ace your Space

BY AVANI MAWAL & HARSH POONIA

## 01 CAFE COFFEE DAY

Perfect spot if you want to pretend to study and make aesthetic study vlogs. Bonus points if you sip your coffee at snail's pace (or get the menu shoved at you every 15 minutes) and read obscure fantasy novels.

## 03 BRAND NEW CAFE

Earlier used to be called the library and rumor has it that people used to actually study there. You can squeeze in a small study break while you wait for your order only for them to give you someone else's

## 05 IN THE EXAM HALL ITSELF

For those that make use of (abuse?) open book policy. Why study the whole syllabus when you can just study the topics that are asked in the peace and quiet of an exam?

## 07 YOUR COZY BED

Don't fool yourself. It is not a study place and you know it.

## 09 READING HALL

For those who like heavy metal music, the construction sounds create the perfect ambience.

## 11 IN THE CLASS

Believe it or not, some people do study here, but this is a myth yet to be confirmed. For the rest of us, awesome place to hangout with friends, read webmail, and play wordle, quordle, semantle and NYT crossword

## 12 UNDER CONSTRUCTION HOSTELS

To assert claim over some piece of hostel land. Nothing like sawdust and flaming shards of metal to keep you awake and on your toes. On-site placement guaranteed if you don't find a new space soon

## 02 HOSTEL GAMING ROOM

Called study room when the exam season dawns, in peak season has a longer waiting queue than Shiru Cafe (shoutout to all my broke friends getting their hourly caffeine)

## 04 CC LIBRARY

Beloved shelter to homeless people who somehow sleep, eat, allegedly bath all while never stepping out of the academic area. Good swimming spot in the rainy season, pretty views at sunset and gateway to illegal rooftops

## 06 CAFE 92

The people waiting will throw you out if they see you occupy the table with books

## 08 FRIEND'S ROOM

Where your friend was studying until you showed up

## 10 UNDER THE STREET LIGHT

For those who believed the "padhne wale bache kahi bhi padh lete hai" jab from their parents. For those on a motivational high after watching "12th fail" or "Good Will Hunting". Great source of passive income🔥 if you keep a bowl next to you

BRAIN  
FRIED!

NEED QUIET!



For those who relate a little too well with 'this is me trying'.  
Or, as a friend said, for when you need a little lift-me-up's.

# AN ODE TO TRYING

For a lot of things in life, there are people around that just... can. Maybe they all attended a secret summer club for the talented and figured it out, some meetup you weren't invited to, maybe they were born with it, but they can see musical notes and mathematical equations. They can visualize intuitively what you couldn't fathom writing down. They can devour linear algebra for breakfast, while you're trying to figure out why your alarm didn't go off.

As children, we're showered with heaps of praise for being "talented" at the slightest hint of being a fast learner. We're conditioned to believe all of us are meant to be good at something, that we're just born with. The idea that talent is something we're meant to discover is deeply ingrained in us. As if skills you acquire from learning are artificial diamonds, their luminance pales in front of real discovered diamonds, their existence itself a giant farce.

The idea that talent is something we're meant to discover is deeply ingrained in us. As if skills you acquire from learning are artificial diamonds, their luminance pales in front of real discovered diamonds, their existence itself a giant farce.

Because being gifted is just... easier. All our heroes were gifted people. We look up to Mozart and Terence Tao, we are awestruck by Ramanujan and Jimi Hendrix. John Mayer can perform Neon in perfect tune, half asleep while you can't properly strum the ukulele that's sat collecting dust in a corner.

Because being gifted is just... easier. All our heroes were gifted people.

You wish you could do it effortlessly. You wish you exuded a kind of nonchalance that people at the top of their game do. Wouldn't it be nice to believe for once that I've got this, I know what I'm doing. Sometimes there's this looming dread of this is the farthest I'll come. There's always going to be places I won't get to and moments I won't live because I'm not good enough.

You can't get everything in life just because you wanted it the most or tried the most. Sometimes hard work just isn't gonna be enough. What if I don't have the music gene, or the math gene, or the "I could swim the English Channel while devising proofs for conjectures in the time it takes you to get up in the morning" gene? Unchecked, this devolves into you feeling like an imposter who doesn't belong, who somehow hacked their way, cheated the system, sacrificed children to make it here, only by trying too hard.

For those who relate a little too well with 'this is me trying'.  
Or, as a friend said, for when you need a little lift-me-up's.

And what are you to do, if not repress this feeling? Talk about it? Preposterous! God forbid if you mention taking your time and struggling with something, because everyone around is just too cool to get why sometimes you have to stop and... bask. Breathe for a while. They'd probably scoff at the possibility. And you remember there was a time where you didn't have to try either. You just knew long division, the same way you knew mitochondria is the ... okay, okay.



When did success become a closed gatekept community? We're afraid to share our struggles because the secret agents of talented people co. are always listening. Your lame track record doesn't sit well.

A form of expression of how we feel, isn't for me to express how I feel. Doesn't that sound ludicrous?

This fear of being imperfect permeates into other aspects of our life. We're afraid of our own mediocrities. We don't sing out loud because our voice doesn't quite leave the room awestruck. We don't dance our heart out to tunes in fear of making a fool of ourselves, because trying to dance, in all our amateurism, somehow feels more embarrassing than conceding to our ineptness and accepting that this simply isn't for me. A form of expression of how we feel, isn't for me to express how I feel. Doesn't that sound ludicrous?

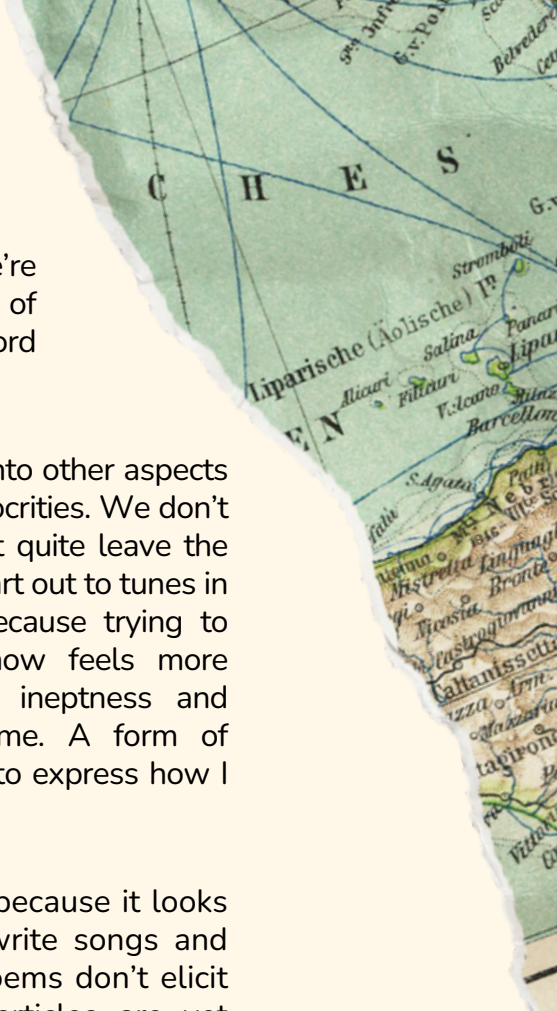
We don't try to sketch the dogs and the trees around us, because it looks like a child filling their 4th grade workbook. We don't write songs and poems and about our deepest convictions, because our poems don't elicit the response Javed Akhtar's would, and because our articles are yet another tryhard wannabe writing attempt. Because to write when you're not a natural is completely unacceptable. because art is only for the seasoned practitioners, and you better be cultured af if you ever dream of partaking in it, pleb!

So here's to writing your heart out, singing imperfect notes, bringing out unpolished moves. Here's to trying things because they bring you joy, to putting all your soul into it without expecting every creation to be your magnum opus. Here's to running out of breath mid-runs, and having your legs get sore after a long cycling journey. Here's to getting ruthlessly dunked on in basketball, and, almost stubbornly, returning every time to play. Here's to going boulder climbing, and getting stuck on the same level for weeks, falling down with all your weight and still having the audacity to begin another climb. Because what would you rather be, to excel at this? A monkey?

Here's to struggling with projects and concepts,  
with deadlines and tests, and honestly giving your all  
to get through,

**HERE'S AN ODE TO TRYING.**

**BY HARSH POONIA**



# Serendipity

## Meeting people by chance...

A college is expected to give way to making a lot of new acquaintances. Rarely do we bond with someone quickly. But it is too surprising to meet so many people in the most unexpected scenarios in the IITB campus. The way you get to meet people in IITB is almost like part of a grand design of meant-to-bes.

The positivity which comes from meeting friends or acquaintances can just be the cure for a tired boring day! You never really have to take a meal alone - even if you are introverted because of the amount of contacts you make here - batchmates, wingies, someone you saw in that one course you took! No major effort on your part is needed, just a soft smile and a heart open to making new friends. The triadic closure comes into effect by default. (Just a social network jargon for mutual friends being friends with higher probability. Also, this is when you realise you're reading a CS magazine).

*That is the beauty of the campus - you can play "which language is it?" guessing game of Indian languages if you walk from one end of the infinity corridor to the other.*

Apart from meeting people in classes, by being a part of the same association or club, being a TA for the same course, going for a run in the Gymkhana or in the gym, we get to know people in many other ways. My experience has especially been that of meeting fellow Tamil students, mostly in the mess. Some people who have randomly caught me ranting to my mother in Tamil, came and introduced themselves, (I do confidently say a lot of things assuming no one nearby understands). The geographical

proximity just makes us friends much more easily. There are now a lot of fellow Tamizhians from various departments and years in my contact list. We help each other quite a lot. That is the beauty of the campus - you can play "which language is it?" guessing game of Indian languages if you walk from one end of the infinity corridor to the other.

It just happens that you meet a lot of people in the lift, the number being proportionally higher with the floor you reside. One simply can't avoid talking if they are carrying your favourite author's books in their hands or watching a reel of your favourite series/TV show.

Other times you get acquainted with people are in long queues of special dinner, while running for an auto rickshaw at 9:29 for a 9:30 class, during a simple NSS activity, a stargazing session or any event that happens in the campus. You meet someone passionate about philosophy, Sanskrit or Literature doing their PhD; someone from the aerospace or remote sensing department. When you hear the stories from their courses, you realise how little you know of the world.

*You may get acquainted with people in long queues of special dinner, while running for an auto rickshaw at 9:29 for a 9:30 class!*

*A russian roulette of what might have been, what if you hadn't run into a bright stroke of luck that day, meeting your best friend, catching hold of that wonderful opportunity!*

Many of my friends befriended a lot of seniors during the placement season. The uncertainty of the interviews made runners offer luck and words of confidence to not just their friends but other candidates as well. IITB is known for its network and alumni reach. But even inside the campus, we meet a lot of people - other sisters and brothers who make you feel at home; away from home. There are some people who you just know by face - no name, no mobile number - just another smile you receive as you walk around the campus.

As ubiquitous as this phenomenon is, we don't like to believe in it. We would rather attribute it to the universe tugging at strings to make these lovely encounters happen. We don't like to believe some of the most fulfilling relationships we treasure are the result of chance. That's the thing with chance - we're not comfortable with leaving things up to it. We don't want to run into precarious situations that might or might not work out, because it's unfathomable to look at life as a series of what ifs? A russian roulette of what might have been, what if you hadn't run into a bright stroke of luck that day, meeting your best friend, catching hold of that wonderful opportunity, making that impulsive decision on which you've somehow convinced yourself your entire imaginable life is pinned on? Serendipitous joys inherently go against the notion of carving our own destiny, of being the masters of our fates and the captains of our souls. But isn't there so much beauty in the simple truth of life - that we don't know where it's going to take us? That perhaps not every part of our story is meticulously planned out, not every verse of our song melodiously penned out.

I see an extroverted sophomore greet everyone around in our mess. She has an aura of optimism & cheer wherever she goes. She tries to speak the language of the person in front and learns a few phrases each day. She has obviously mastered the art of making new friends. When asked how she feels about meeting new people, she shrugs telling it's time to play badminton with her friends she met in one of the insti-clubs.

*Perhaps not every part of our story is meticulously planned out, not every verse of our song melodiously penned out.*

**"So, next time before using the earpods as a natural excuse to not see or hear anyone around, spend a few minutes observing people. Who knows, you might meet your next new friend there!"**



**BY SWETHA MAGESH**



# WEB3

## A farce or the future?

BY HARSH POONIA & AVANI MAWAL

In the ever-expanding realm of digital innovation, a new chapter was inscribed – one that promises to redefine the very framework of the internet as we know it. Web3 is the vision of a decentralized and user-centric internet that is built on blockchain technology. But is web3 really all roses and rainbows? Through the power vested in us by absolutely no one, today we investigate - Is web3 a giant farce, or can it live up to its promises and build a better internet?

### Can web3 build a better internet?

The goal of Web3 is to shift the internet from being dominated by centralized platforms to a more open and inclusive digital ecosystem, it promotes the development and adoption of decentralized applications (dApps), cryptocurrencies, smart contracts, and other technologies that prioritizes user privacy and data ownership, reducing reliance on tech behemoths such as YouTube, Netflix, and Amazon.

Challenging the previous versions of the internet, Web3 emerges like a rebellious child of cyberspace allowing individuals to have more control over their data and content, moving away from the "walled gardens" created by large tech companies.

Web3 advocates say that decentralization could reduce the power of the biggest internet companies – Amazon, Google, Microsoft and Facebook – and give it back to the users. But will it?

Investors pumped \$23.7bn into startups associated with the idea. Venture capitalists, attracted by potential profits, have fueled the hype around Web3, driven more by FOMO than genuine belief in their success, leading to unrealistic expectations. Furthermore, a group of advocates, including technologists, entrepreneurs, and influencers, has promoted web3 as a revolutionary force for decentralization and empowerment. Despite their enthusiastic portrayal, the practical challenges of implementing web3 solutions remain unclear.

But not everyone is sold on these utopian promises. Jack Dorsey, founder of Twitter (yes, bird app) said “You don’t own web3. The VCs and their LPs (limited partners) do” hinting at how centralisation could quickly take shape and only this time, it would be to give control of the internet from corporations to crypto bros. Big VC firms are pouring billions of dollars into creating an alternate world of finance, entertainment, gaming, commerce, etc marketing the new world as “Decentralized.” Skeptics say we’re just not looking close enough at the implementation of such an egalitarian paradise because a story about the rebirth of cyberspace is simply more compelling. SWE Stephen Diehl went so far as to say “The only problem to be solved by web3 is how to post-hoc rationalize its own existence”. So why so much scorn for the idea?

## 1. COMPUTE PROBLEM

Blockchain networks simply do not scale, or in the cases they do, they simply mimic the plutocratic and centralized systems they were designed to replace. The cost of doing trustless computation is enormous, since there has to be a consensus by all the (mutually antagonistic) players in the game about the state of the giant network. The compute power of the entire ethereum blockchain, for example, is roughly 5000 times less than the Raspberry Pi 4, a single board computer costing Rs. 3500! This is ridiculous without even considering the fact that modern cloud computing infrastructure offers cheap compute resources. The alternative here is Proof of Stake, which comes uncannily close to being a “he who has the gold makes the rules” system. This, coupled with VCs and founding partners often getting the lion’s share of the initial token allocations, really makes one question the power dynamics at play here. Visa, the payments company, can process 24,000 transactions a second, while bitcoin can only process 7. Decentralized finance simply seems too computationally infeasible at this stage.

## 2. LOGISTICAL NIGHTMARE

There is a reason centralisation emerges - efficiency, in cost and service. Moxie Marlinspike, founder of the messaging app Signal says “... people don’t want to run their own servers, and never will...I don’t think this can be emphasized enough.”

which means a truly distributed architecture envisioned in our utopia may not exist. And this is before we even get to making this thing compatible with society. When no one wants to follow the rules, who is going to enforce copyright guidelines? Who is going to decide whether to ban or unban Kanye for the 5th time this year? Who takes on the gargantuan task of battling fake news?

## 3. WASTEFUL IN STORAGE

Long story short, storage on the blockchain is hella expensive. And the blockchain is an immutable ledger of every transaction that’s ever happened. The notion of data deletion simply doesn’t exist. Storing a measly 3kB on the ethereum chain costs a whopping \$250! To make storage any feasible at all, our best (and perhaps only bet) is to store data at a centralised server and refer to the hashes on the block.

So is the hype around web3 artificial and propagated by those that stand to gain from it? You can’t help but notice the strongest proponents of web3 have massive financial incentives, as stakeholders in the crypto projects they endorse on, yes, twitter of all places. The main aim seems to be financial deregulation and immunity to wrongdoings. This hype being drummed and targeted towards beginners resembles a ponzi scheme, where the only way for early participants to make money is by recruiting further fools to join the circlejerk.

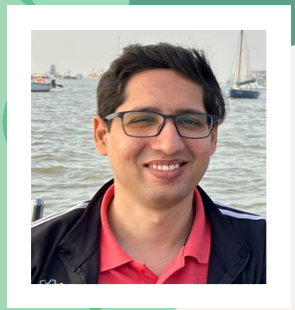
## VIRTUAL REALITY AND THEFT

Even if you’re unfamiliar with the technical underpinnings of NFTs, you know they’re littleworks of art that can be bought on the blockchain. And boy did they get bought. During the peak of their popularity, some were sold for tens of millions. When the fog around them actually cleared, we saw the rubble - nearly all of them are worthless investments as of today. Owning an NFT is the same as buying a cake, except that anyone can come and eat your cake, you buy it not from the baker but the person who stole it from the bakery, and it’s practically not even your cake, and all you have to show for it is a clown certificate that you get with the purchase. But NFTs aren’t even the most expensive thing to have nosedived in value, that honor is reserved for silicon valley’s poster boy, Mark Zuckerberg and his pet project, the Metaverse. Who would’ve thought people wouldn’t want to go on virtual aquarium dates? The only person who always seems to look exactly like his digital avatar and has any fun with the idea is Zuck himself.

So where has everyone moved on to? Pretty obvious to guess, it’s AI. Everyone - from giant corporations to VCs - has placed their bets on AI to transform the world. This pivot means web3 won’t be seeing major and loud changes for a while now. Time will tell if web3 really turns out to be the revolution it was branded as, or a ponzi scheme that fell apart.

# An Evening with Prof.

## Manas Thakur



BY AMEYA DESHMUKH

**Can you explain your current research in compilers + programming languages, to a CS undergrad who hasn't had much exposure to them yet?**



Heap allocation is expensive. You have objects with levels of indirections through pointers for field accesses. In managed languages like Java, you also have a garbage collector running in parallel to reclaim unreachable memory. What we are trying to do, as a multi-year project with IBM, is optimizing memory allocation on the heap by trying to move as many objects as possible on the stack. The good thing about the stack is that once the lifetime of a function is over, you can simply reclaim the associated objects.

In particular, we are trying to do this for languages with dynamism eg. languages that allow changes in the code during execution. Here, we also need to efficiently undo whatever compiler optimizations we have done which are no longer sound. The good thing is that we are implementing all of this in a real world Java VM, and we already have pull requests that have been accepted. This allows our work to be used by anyone to speed up their programs!

**When did you know that academia was your calling? What was your motivation to pursue a PhD, and what did you gain from the process?**



My grandfather was a retired teacher, and my house always used to have books all over. I liked to be in such a setting. Moreover I am an only child, so I had a very disciplined upbringing with lots of motivation to be the conventionally 'good' student. In turn, I developed a longing to become a person like my teachers.

PhD is a very rigorous journey that prepares you to face almost anything in life: rejections, pressure, managing relationships. In retrospect, it doesn't look as tough, but when you are in the process it is completely different. In those years, you are in an environment which is guided, and yet you are free. This allows you to look within and develop strong convictions and philosophies of your own.

**Did you consider career trajectories other than academia?**



I did, but everything that excited me always involved academia in some flavor. I was offered jobs at industry out of college, with one offering guest lectureships as and when possible. At one point, I considered doing a course in Yoga, and I loved the idea because that would allow me to teach Yoga. Some people felt that being a disciplined child with his heart in the right place, I was fit for the administrative services. That idea itself didn't excite me, but that of affecting people's life for the better stuck with me. Academia allows me to do so, albeit at a slower pace over multiple generations.

**We see that you have multiple collaborators from abroad, but you seem to have done all your study in India. Didn't you consider a postdoc abroad, and how do you compare doing research in India versus the top institutes outside?**



I had postdoc offers from the US, Australia coming out of PhD, but I wanted to stay close to my mother so I opted to go to IIT Mandi. Choosing where to do your Masters, PhD, postdoc requires a lot of homework. The most important factor to consider is the quality of the research output of the particular group, and whether they are trying to push to the top conferences, journals in the field. Location, rank of the university is subsumed by this.

In my case, I chose to stay for a personal reason, but ended up working with two brilliant groups from abroad while

at IIT Mandi, with my students. As good as doing two postdocs in three years without going anywhere!



**How does the excitement, nervousness, and amount of preparation required compare between the first few courses you taught at IIT Mandi and courses you teach here?**



Preparation is always needed if you are serious about offering a course, no matter what. Giving various talks at colleges, industry events, workshops etc. as a PhD student had given me some experience, and gotten rid of my stage fear. But planning a semester-long course is an entirely different ball game, and requires very far-sighted vision. My first course was a UG compilers course. The planning for the first few lectures itself took me around two months, and I received positive feedback quite early on!

My second course was Paradigms of Programming (PoP). Two of the most acclaimed offerings of this course then were the one at MIT, and the one here at IITB taught by Prof. Amitabha Sanyal. So I got in touch with the instructors to understand their perspectives. Additionally, I was supposed to teach 6th semester students, while these courses were built for 1st year undergraduates, so I also had to align the content appropriately.

Not much has changed in these aspects for me, except for the increase in the class strength here. It has its advantages in the increased number of interesting questions and perspectives, but at the same time the logistics, evaluations become all the more tedious.

**Core courses vs Electives. How are they different from your perspective? Do you enjoy any one more?**



In a core course, you need to uncover a fundamental body of knowledge, while in an elective you want to discover new stuff, excite the students, maybe get some research leads out of them. A core course allows me to hone my teaching skills, and I enjoy when students are mesmerized by the level of preparation that goes into explaining the concepts lucidly. I aim to do so with Interpreter design in the next PoP offering. In an elective you can improvise more, go in with no slides, encourage the students to challenge the state-of-the-art on each topic, etc.

**You travel a lot. What are some of your most memorable travel experiences?**



I've had some crazy experiences with Flights and Food. I have caught an international flight almost just before take-off in a full sprinting-in-the-airport fashion, like in the movies. I have had my VISA application sent back, and subsequently received it in 15 minutes after standing outside the embassy for hours with out-of-the-box help from a professor. Once in Prague, I went out to an Indian restaurant with my colleagues and by the end of the meal I was the only person not in tears!

A memorable aspect of any trip is also the new acquaintances you end up making. I am still in touch with people from a tour I took during my solo trip to London!

**What are the qualities that you have picked up from your PhD advisor? What are some things you expect from a good PhD student?**



When you join for a PhD one of the first things you are told is not to look for a friend, philosopher, and guide all in one human. But my advisor was all 3 and even more. He made sure that we did quality work while I gained independence as a research scholar. Because of the treatment I got from him I think of all my PhD students as my family.

Not being isolated, and not putting myself up on a pedestal are things I have learned from my advisor. You have to show your human side to your students in order to have meaningful conversations, and build a bond with them. You would find many occasions when they look up to you and instances where you can indeed make a life-time difference. From a student I expect sincerity, respect for time, honesty, and not trying to be more or less than what you are; even as a mentor I try to do the same.

**Are you in touch with pop-culture?**



There is a reason why some of my assignments are Harry Potter or GoT themed! I enjoy such high-fantasy series as well as feel good movies such as 'The Pursuit of Happyness', 'A Man called Otto', 'The Intern', etc.

**What are your hobbies and how do you find time for them?**



In Chennai I became spoiled with all city-stuff. I enjoyed regular outings, movies etc. Mandi was a big change, no malls, no theaters, sometimes no food delivery. Living there made me realize that all of it wasn't something I enjoyed as much as I thought.

Now, I enjoy peaceful places in the campus, listening to the waves at Mumbai's beaches, sitting with a book, playing indoor games such as Ludo at home, exploring new cuisines. I also try to find joy in small things that don't take up too much of my time; take for instance this plant I have in my office. Everytime I see a new leaf grow on it I get very excited!

**When did you start doing Yoga? Do you still regularly practice it?**



During my PhD, I gained a lot of weight being a couch-potato! I decided to join an evening Yoga class for my health, around 2016, and it has stuck with me since then. I love that there is no 'wrong' way to do Yoga, and also how convenient it is. It is physically refreshing as well as mentally peaceful for me. When I stood on my head for the first time after 1.5 years of thinking it to be impossible for my body – I knew a human can do much more than usual, with persistent effort.



./closing\_remarks

THE HIGHEST NUMBER OF TURING AWARDS TILL DATE HAVE BEEN WON BY RESEARCHERS WHO HAVE CONTRIBUTED SIGNIFICANTLY TO PROGRAMMING LANGUAGES. THIS REQUIRES A LOT OF QUALITY WORK.  
THE FIRST PERSON TO WIN A TURING AWARD, ALAN PERLIS, OPINED THAT AS COMPUTER SCIENTISTS AND ENGINEERS WE SHOULD ENSURE WE KEEP FUN IN COMPUTING; ONE SHOULD BE ABLE TO MAINTAIN THE JOY THEY GOT ON FIRST BEING LED TO THIS MACHINE,  
THE FEELING THAT THEY CAN MAKE IT MORE.  
MY GOAL IS TO FACILITATE BOTH TOGETHER: QUALITY OF RESEARCH AND TEACHING WHILE MAKING SURE WE ENJOY THE PROCESS. OF COURSE, AT THE END OF THE DAY, THE WORLD IS CIRCULAR:  
"YOU POUR LOVE, YOU GET LOVE."

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# BREACHED!

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## Unveiling the Shadows of System Insecurity

In today's world of computers, it's of utmost importance that we keep our systems secure. But what exactly do we mean by "secure"? People have various definitions, but for me secure just means to prevent unwanted access to our data and software. My piggy bank is secure when only I can access the coins inside, not my siblings. Now that we have a definition of secure out of the way, it's natural to ask "Are our systems secure?". Turns out vulnerabilities exist all around us. Many are trivial and hide in plain sight while few are extremely hard to exploit. Here I'll mention a few of the vulnerabilities that I found in our institute softwares/systems.

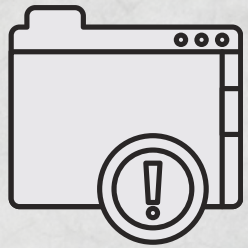
 HOW TO GET AWAY WITH MURDER (ON MARS)?

Let's start with something that all of us use - cse mars accounts. Yes, it's the place where you tried to mine bitcoin once only to realize it lags while playing minesweeper. Do you think it's safe to keep your vital data on mars? Turns out mars is a combination of vulnerabilities. Everyone can access their mars directories on SL machines using a simple login. But the actual data is stored somewhere else in servers. How do they make this possible? Answer is they use NFS - Network File System to mount everyone's mars directories on every SL machine. In this case mount simply means to make available files for you to access on your machine which in fact are present on some remote server. This is done so that every student can access their files on SL machines without much effort. A simple `cat /etc/fstab` reveals the ip address and other details of the NFS server.

Now someone thought it was a great idea to give docker access on SL machines for a course that we have. And with docker came root privilege! Now you could say, isn't containerisation and isolation the whole point of docker?

Mounting some directory inside a docker container allows you to access the host files inside the container. You ideally do not want the whole of the host filesystem to be accessible, so instead you mount the needed directories and access them from within the container. An innocent looking feature which exists to make people's life easier (or harder, the way you want to see it). So we just mounted the `/users` NFS directory inside docker and voila, we had complete access over everyone's mars directories! The above vulnerability was reported to appropriate authorities and subsequently has been fixed.`

Let us now dive into microarchitecture for a moment. We give a simplified overview of the Spectre - a kind of speculative attack.



So here's the setup: you are playing a virtual game of cards with your friends, and the stakes are high, the winner of your online royal rumble will get a treat. Let us assume all of the cards are faced down, and you can reveal what's behind any of your cards by clicking on them. Clicking any of your friends' cards is futile though - the game only allows you to see your own cards. Say everytime you click on a card, the program checks if you're allowed to access it, and if you are allowed, it fetches the image of the card from somewhere in your PC where game assets are stored, and displays it on the screen.

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# THE SPECTRE



Let us go on a quick tangent and talk about what Branch Predictors are. A branch, simply put, is an IF statement that decides whether or not the execution proceeds inside the block when

the condition is true, or it skips it when the condition is false. In our example, the branch is said to be taken when the condition is true, that is, a player accesses their own cards. The job of a branch predictor is quite literally to predict whether a branch will be taken, based on the history of this branch. If it is taken very frequently in the past, it is likely to be taken again. If the prediction is correct, it saves us the time taken to actually evaluate the condition. If the prediction turns out to be wrong, no worries, the wrong execution is reversed and it resumes from its correct place. So how can you use all this to find out your opponent's cards? Every time you click on a card, the program decides whether or not to display the card based on the player, that is, whether or not to take the branch.

Say you click on your cards 100 times, each of these 100 times the branch is taken and our predictor is sufficiently trained so that it predicts true next time. If you then sneakily click on your opponent's card, the branch is predicted to be true and the image of their card is fetched into the cache. What is a cache, you ask? Think of it like a small place of storage that you can access quickly, sort of like a schoolbag. You cannot take all of your books to school,

so for any given day, you keep some books that you know you'll need in your bag. Similarly, in our case, the computer cannot access every single asset of the game quickly, so it keeps those which it expects to use in a cache. Now mind you, even after your sneaky trick, your opponent's card will not be accidentally displayed on the screen since the condition evaluates to false (you do not have access to his cards) and so the wrong execution of taking the branch is reversed. The attack lies in the nature of this reversal. The cache state after a wrongly taken branch is NOT reversed. This means that the image of your opponent's card is still in the cache. Now the cache is not visible to the user, it is merely a computer's way of organising things for quicker access.

# THE FINAL PIECE OF THE PUZZLE, AND YOU WIN!

So here's the final trick up your sleeve - you can access all of the card images from where the assets are stored, say in a folder. This folder is where the game fetches card images corresponding to a value, say ace of spades. Now if you access all of these images, one by one and measure the time it takes for it to load and display on your screen, you'll notice that images that were already present in the cache are fetched quicker than others. One image stands out here - it will not be a part of your set of cards, but was still fetched quickly. You're right, this is your opponent's card that was falsely fetched into the cache!

This analysis of fetch latency to leak information about the cache state is called a cache timing based side channel attack. This sequence of training a branch predictor on legal accesses, making an illegal access and performing a cache timing based side channel attack is called Spectre.

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Please note that this is just a toy example for demonstration, and the actual attack is more technically involved than this, but hopefully it gives you a flavor of how cool systems research can be!

Let's move on to some attack that doesn't feel real! Before that we need to understand the difference between persistent and non-persistent memory. For now, assume that persistent memory is the one which keeps data intact even after you turn off your PC, while non-persistent memory is the one which loses its data after you turn off the PC. RAM is an example of non-persistent memory while Hard Disk is an example of persistent one. Now whatever passwords or encryption keys that you use will likely reside in your RAM for the duration the machine is ON. How exactly does the RAM store each bit of data, zeroes and ones? Each bit is stored as the presence or absence of an electric charge on a capacitor (yes, the thing from school that's famous for malfunctioning ceiling fans and storing charges, also in that order).

WHERE CAN I BUY LIQUID NITROGEN AND HOW DO I RIP OUT RAM?

As time passes, the charges in the memory cells leak away, so without being refreshed the stored data would eventually be lost. To prevent this, contents of each bit are periodically read, and the charge restored to its original state, so the RAM is always refreshing.

When you turn the machine OFF, data simply vanishes as the charges leak away. Read that again. If you were to recover the contents of the RAM after it has been powered off, you would somehow need to stop this leakage of charges.

Buckle up for some serious school physics nostalgia. We know charges are just electrons, and if we cool down these electrons, they don't diffuse as fast. If you were to smack open your case, rip out the RAM and dip it in liquid nitrogen, it could slow down this fading away of information to make that data persist for a few tens of seconds longer. In that short window, you can retrieve the data by connecting RAM to some other device.



Now of course we didn't use liquid nitrogen to carry out anything. But inspired by this attack, we did something similar on a virtual machine. It's easy to retrieve the RAM dump from a virtual machine, thus making cold boot type attacks possible. I won't be able to go into specifics here as the vulnerability is still live (and yes it's present in some software that a lot of students from our department use everyday) and to the best of my knowledge it is unfixable!

BY HRISHIKESH JEDHE DESHMUKH

# WHY DO IIT UGs DO WHAT THEY DO

## Student Stress, Engineering Careers and IIT's Mission

BY AARYAN DANGI



Why do IIT students do what they do? Why do they take up careers in certain fields, engage in particular activities during college while ignoring others? Why do they choose to skip classes, instead opting to manage various events?

Before we delve into the central question, let's address a few preliminary matters. One such concern is the perception of student stress within the administration, a subject frequently discussed in senate meetings. Stress, anxiety, worry, pressure... How can we reduce it?

### What causes student stress?

Prior to answering these questions, we first pose a different one: does the administration view JEE as a cake walk? It's an unsaid secret on campus that, regardless of major, or year of study, academic load is substantially lesser than what it used to be in the JEE days. Yes, there's stiffer competition, if you're one to partake in it; but there's no honest comparison. Relative to following the strict routine of getting up early, solving difficult problems, getting your queries answered, trying to improve test scores, day after day? No way. So, what gives the impression of such student anxiety to our administration?

Stress is a combination of two things, essentially: the uncertainty of an outcome, along with the negative consequences associated with that outcome materializing. Hence, the reason for student stress is simple: their career, and thus their future, is uncertain. The field they choose to go into, how much they earn in their first job, the role they get selected for... all this plays a big role in deciding what their future looks like. The house they live in, the car they drive, the healthcare their family can afford, the school their kids end up going to. Worse, as students look around, talk to their seniors, come to grasp the importance of internship and job placements, they realize that there are very few meaningful opportunities to decidedly improve their outcomes. Offering fewer compulsory courses has very little to do with anything.

### Why is class attendance so low?

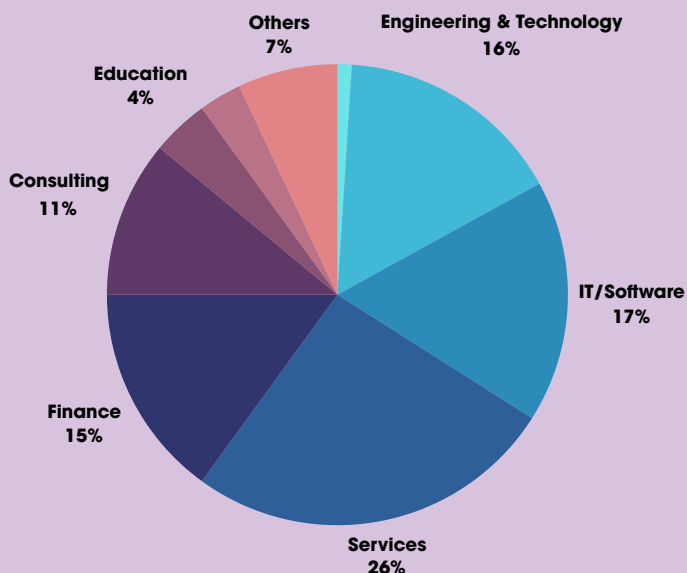
Behind every mass phenomenon, there is an incentive structure at play. Statistical differences in corruption across countries are much more to do with economic and legal incentives in the said country than the moral fiber of its citizens. What you reward, what you punish... that is everything. To answer the question of why students don't attend classes, we must first ask: what motivates them to do so? What's in it for them? That they shall pick up tricks of the trade, get good grades; well, for most career paths, these tricks and grades are not that relevant anyway. It is good to maintain your grades above a certain threshold, but it is not enough to warrant attending classes regularly.

So, shall we cut the number of classes each student has to attend? And then... what? The administration seems to be in the mood for enforcing this sort of silliness, but removing academic load without incentivising clear alternatives is akin to increasing the time students have to engage in a very particular brand of "recreational activity". Great for the dealers in town, but not many else.

### Why do students opt for non-engineering branches?

A quick brief through the highlights of IIT Bombay placements for the year of 2021: the primary domains were software development, consulting,

## Section-wise demand for B.Tech



finance management and services, and engineering and technology. Core engineering just made up for about 16% of all jobs offered.

Why is this so? Although we've approached the issues of student stress and low interest in the academic curriculum, we have still not addressed the central reason behind this. The core of it lies somewhere else... and it explains a lot of what we've discussed so far. For a consulting role pays more to a fresher than he would get being an entry-level chemical engineer. But having 4 years of education in a specific field should make a difference. Why does it not?

The IITs were designed as a system of higher education, modeled on the great pre-existing giants of the west. Their organizational hierarchies, their reward systems, their professional avenues. But India is not the west; and therein lies the fundamental issue.

Our entire university structure, end to end, is built to mimic the west- in curricula, at least. Still, with their system in place, they produce and attract talented chemical engineers, consistently. Why can't we? Well, it is the difference between an economy which can offer a certain class of standard of living, and one that can't. If you can guarantee a minimum level of income, people will take your road, follow their interests. They will take the risk. And in that case, you can keep an open curriculum, and have abstract, theoretical classes.

Go ahead, keep the option to switch majors open, let your students take the courses they want, keep things flexible. But if you want to seriously train talented chemical engineers, and cannot offer as smooth a ride ahead of them... this system is likely not your best bet.

## What can we do to promote engineering?

Why should someone pay a young, inexperienced chemical engineer? They just are not going to be able to offer as much, irrespective of the classes they took or the college name on their degree. What is the alternative? Well, produce a young, experienced chemical engineer!

At the end of the day, the IITs are not just an engineering institute, and they never will be. They are a brand name, a global symbol. But if you are investing your resources in training the best students of the country in specific engineering fields, and have the nation's top research fellows working for you in these fields, there must be a justifiable purpose behind it. Pick a lane and stick to it, pivot one way or another. If the objective is to nurture talented folks who can become global leaders in a trade of their choosing, then it is time to move away from the traditional engineering curricula. But, if the nation needs a larger supply of young, talented up-and-coming chemical engineers, then reduce some of the academic load- yes- and start promoting more hands-on industrial and government projects. Internships, paid work, where students solve problems that need solving. Experience that is valuable to the profession. It is time to move away from superfluously following the west's model, and deal with our problems like they are our own.

When the director of IIT Madras claimed that the students were at fault for not pursuing engineering as a career, due to reasons like a comfier life and better pay in other fields, he was wrong. He overlooks the nuance in our situation. The IITs, as birthplaces for the nation's leaders and visionaries, bear the responsibility of demonstrating that the incentive system in place goes beyond merely maximizing entry-level pay for its students. The university needs to clearly state its objectives, and clarify its path to align with those objectives. It's a subtle problem. And it's going to take much more than pointing fingers to solve it.



## Unravelling PhDs | Talk with Seniors

# ADITYA KUSUPATI

Paul G. Allen School of Computer Science & Engineering  
University of Washington

**It has been 7 years since you graduated, and because things look a lot clearer in hindsight, what are some of the things about the time you spent here that have had an impact on your life and career?**

Seven years post-graduation (Actually five, since COVID kind of took away two years), my time at the department has become clearer in hindsight. Insti taught me resourcefulness and the value of learning from peers. The all-round development here laid a strong foundation for my career. Looking back, I realize I wanted to explore more, perhaps delve deeper into research. What I learnt from the structured learning approach in college and in my experience while doing PhD and in the industry are very different but the structured learning provided insights and a gist of topics I might not have discovered on my own.

**What things have absolutely not mattered even though they looked like urgent burdens in the short term?**

Placements and specific grades seemed urgent initially, but in the long run, their significance dwindled. What truly matters is long-term growth and personal development. I've learned that specific GPAs or positions of responsibility don't define success. PoRs should be more of a thing you enjoy doing. My tenure as an IC helped me find a new circle outside of the department and being the DGSec of the department helped me get good at managing a very busy schedule. For me, it was always about finding the balance, enjoying life, and being supportive of others.

**What value does a PhD offer in its own right, not as a stepping stone to something or build up to a potential career in academia or industry, just the learning and experiences in those years for a person?**

A PhD is not just a stepping stone; it's a transformative life experience. Beyond technical skills, it involves critical thinking more than you have ever done before. You learn to reach out for help as well as be there for others when they need support. You figure out how to work alone and how to collaborate when working with others. Your communication skills, presentation skills, and engineering skills improve throughout the journey.

**How does one decide if they are cut out for a PhD? What are some of the things that one should look out for that could help gauge inclination toward this path?**

Deciding on a PhD requires evaluating one's passion for creating something new and a willingness to embrace challenges. A lot of people are good at solving problems but finding the right problem for yourself is a harder skill. You should consider a PhD if you like freedom, but you need real research experience to make a decision. Doing a PhD without research experience can cause a huge mismatch of expectations. A lot of mentorship is given to you as Undergraduates but as PhDs you have to do a lot of things yourself and it's terrifyingly lonely if you don't know how to handle that.

How does one go about choosing their advisor and school to apply to considering it probably is the most important decision one has to take before embarking on this journey?

When choosing a school and advisor for your PhD, give appropriate weight to both a good school and a good fit with your advisor. The latter is crucial, as mismatches can lead to dropout. Consider the peer environment as well; surrounding yourself with motivated peers enhances the experience. While prestigious schools may seem appealing, assess the current state of their departments and peer groups. Research extensively and seek advice from current students to gauge the environment accurately. Additionally, match your research interests with potential advisors and inquire about their ongoing projects. Engage with faculty and students at conferences or through email to gather insights.

How has the ML research landscape changed since you started, particularly with the rise of LLMs?

I started at Microsoft Research in 2017 and stayed till 2019. During that time, I witnessed a significant surge in deep learning, particularly outside India. There were notable advancements, especially in areas like object detection. The real game-changer arrived with the rise of Large Language Models (LLMs), which completely disrupted the landscape. LLMs, what they did was to show that a lot of the problems we are trying to solve as part of research at a smaller scale don't actually exist when you go to a larger scale. They did not actually solve all the problems. But what they showed is a lot of problems could be solved by scale in very simple objectives. By scale, you mean just a lot of data and larger model size. And the ingenuity in the technique is minimal.

What are your most cherished memories from your undergrad days here?

My undergraduate days were filled with cherished memories, from academic failures and successes to supportive peers, juniors and seniors. I'm grateful for the opportunities and experiences that shaped my journey. I would not have done anything different in retrospect. Maybe I would have got a slightly higher GPA if I knew that I wanted to be a PhD. Apart from that, I don't think anything I have done would have changed anything and probably having a lower GPA is why I am able to do a lot of these things. Because I took a slightly non-traditional path, didn't go to masters, and wanted to explore research. So even if I didn't have the best GPA and lamented about it for a year or two, I'm very happy about how things turned out.

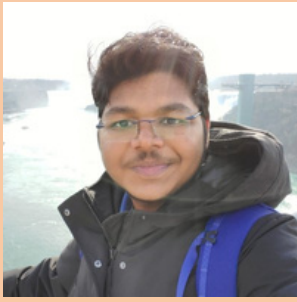
Your survival guide to a PhD?

My advice for navigating a PhD journey includes having fun, maintaining conviction, and choosing the right problems to tackle. I don't recommend being worried with trends but be aware of the trends. It's essential to break out of negative cycles by taking a break by taking up an internship, some new courses, maybe even a vacation and then restarting with a fresh mind.

Advice for aspiring UG ML researchers?

Your first project should be a well-set project and you should do it as literally to the T as your advisor would say so that they can believe that you can execute. In the second project, you can start leading the effort. But the core problems come from the advisor. And if you show independence in this, then in the next project (if you ever do one) you could lead the project and you could even propose the problem yourself. Why am I suggesting three different projects is because you will learn different things in different stages. The exposure you get this way is not only restricted to one area of work but you could also replicate this across areas. So you first understand how to do research and then probably realize that you don't like something or you like something. You'll never know for sure but eventually you kind of know. You find out what you like after reading a lot of papers. You should not shy away from reading papers and you need to be able to evaluate the quality of an idea very quickly. You should be able to project things very quickly. And these things are going to be transferable across. So you need to be gritty. You need to be able to implement things from scratch, see how it works and then improve on top of it. My way of judging an undergrad is if I give you a problem and if I give you a bunch of to-do's, if someone gives finish-ups of the to-do's, they're pretty good. I don't mind. These are the first set of people, who just do the to-do's and come and say, this is failing. Second is the set, who will tell me the reason why it fails. Then there is the third one who fixes it. You eventually want to become the third person. But you need to go through all the phases first.

BY ADYASHA PATRA



# THE STARTUP CHRONICLE

Formerly Senior Research Scientist @ Google Brain

Founder of Ideogram

## CHITWAN SAHARIA

By Harsh Poonia & Anand Narasimhan

How is it meeting and working with people such as Geoff Hinton, Yoshua Bengio, etc. Is it immediately clear how far ahead they are?

Not really, no. The first time I met them, I didn't even think about that, I didn't register what was going on. When I first met Yoshua, it was the first day of my internship, I just directly went up to his office and he introduced me to his whole team. I didn't get a chance to work very closely with him in my first internship there, but I had a much better experience during my second internship, working on a project in which he had a much better interest, and he would attend weekly meets. He was also available for 1 on 1 chats. Those chats weren't too productive to me with the level of knowledge I had; We were not talking at the same level. I prefer advisors who think from the ground up, talking about implementation and potential difficulties, over people talking on the basis of theory. Back then, I found it more useful to discuss implementation details and potential difficulties of an idea with my advisors. I got this mentorship from some excellent PhD students and engineers at MILA such as Maxime Chevalier-Boisvert and Dzmitry Bahdanau. With Yoshua, I would chat more about the high level details.

Geoff gave me a chance in his lab, took time out to make me feel welcomed in the team, despite me feeling like an outsider, intimidated by research people. Apprehensive of going into theory of deep learning : Had a lot of intuition, but could not immediately back it up with the math. I found over time that many times Geoff also came up with ideas through pure intuition which helped me become more confident about my methods.

Do you see yourself as an Engineer in the way you think of things?

I believe being a good machine learning engineer is valuable. If you want to make something really impactful, you need to be a good engineer. There was some theory aspect to figuring out the right formulation for modeling sequences (e.g. autoregressive models, VAE, etc.) , which was done around 10 years ago, but scaling models to billion or trillion parameters is primarily engineering, and that's the most exciting part to me. There is a common saying in Machine Learning that "Ideas are cheap; people who successfully execute them deserve most of the credit." When it comes to machine learning, there's a lot of theory in papers like Diffusion Models and GANs. However, I find it more productive to focus on the pseudo-code, algorithms, and what we actually implement to understand what they're really doing. Getting to the core of the paper, understanding its function, and building intuition about why it works is more important to me than just looking at it from a mathematical point of view. If I can't simplify a paper down to a few words to summarize it, then it's probably not an idea that will last forever. Only simple things last forever :)

What are some things in your time in insti that have had a profound impact on your life?

Getting a good set of friends :) I'm still close to my friends from the institution; we talk every week. Having a set of intellectually curious people that share the same experiences, similar background and trajectory in life, is one of the biggest contributions that the institute has given to me. I had my BTP under the guidance of Preethi Jyothi ma'am, and she's a very nice person. We still stay in touch and am delighted to share with her any papers I published or products we launch.

Work at Google : How much freedom do you get working there, as a person who's doing Industry research? Do you work on your own ideas?

Working at Google Brain offers a lot of freedom. The motto is "Curiosity based exploration." The main goal is to conduct excellent research. You can talk to people and explore their ideas. If you have your own idea, you can convince others to work with you on it. I try to find problems that are really hard but on the horizon of being solved. Text-to-image paved the way for text-to-video, it wasn't too difficult to bridge that gap. Impact is another thing that needs to be considered, if it's not big enough, why solve the problem?

While approaching projects, do you normally come up with an intuition first and back it up later?

Reviewers usually want to see some math in papers, so you have to back up your ideas. But now that I work on a product, I don't always have to justify things as long as the product works well. In research, I've learned from many people that you can often find math to support your intuition, sometimes tweaking the math you initially thought of. For example, in the original Diffusion Models paper, the objective function that actually works is a re-weighted version of the objective function that comes from Maximum likelihood estimation.

Why did you leave your role as a Research Scientist at Google Brain to start your own startup?

At first, I was excited about building my research profile, writing papers, and getting them accepted at conferences. But after working on Text to Image technology, I saw its potential to be useful and impactful right away. After that, I wasn't as interested in just publishing papers about it; I wanted to make it available for people to use, to ship the product to them. Additionally, I found a group of people I trusted and connected with deeply, and we all believed that starting a startup was the right move. I had worked closely with my co-founders at Google for three years, and we had developed a strong personal bond as well.

How is a day in your life as a co-founder of a startup?

It's pretty chaotic. Each day brings a different emotion; it could be governed by a tweet you see in the morning. If a competitor releases something, it has some impact on how my day would go. But my focus remains on machine learning, training models, and making strategic decisions about where to invest my time. Since my time is valuable, I prioritize tasks carefully. I may need to inform others that I'll be completely occupied with a particular project for a week or more. I decide which meetings to attend based on their relevance to my work and whether my input is needed. If I have an important coding task that requires uninterrupted focus, I might block out my schedule for the week and work without interruptions.

## What is the value of working in a startup, and what has been your main learning experience?

In my previous job, I had a limited set of skills. Now, working in a startup, I see the world from a broader perspective. There are many aspects to consider beyond just machine learning, such as frontend and backend development. The exposure to these different areas is rewarding. I've also learned valuable people skills, such as conducting interviews, evaluating candidates, and having difficult conversations. Learning to be upfront and saying no when necessary are important skills too. I'm still young, and even if the startup doesn't succeed, I don't have much to lose, and I'll still be better off than before

## Do you have any advice for people here? Are there things you wish you could have done more of?

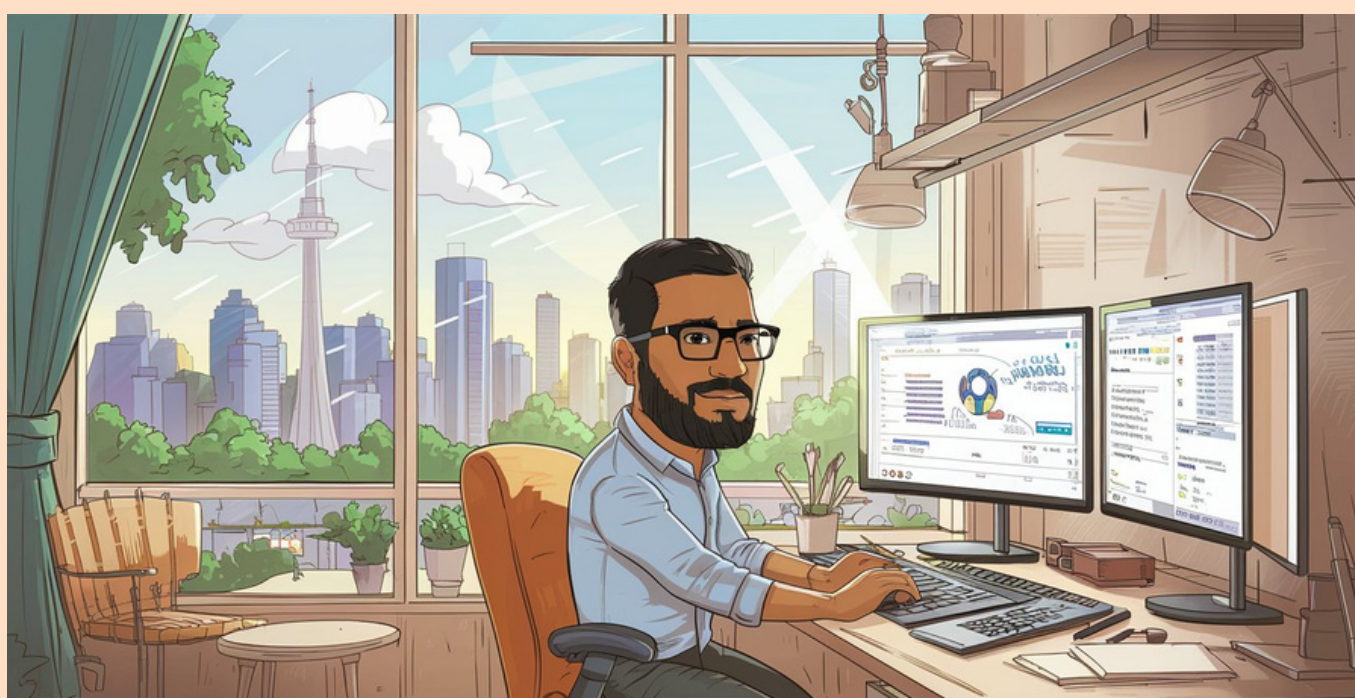
If you're interested in research, it's beneficial to start early. Looking back, I realize I had a lot of free time in college that I could have used more effectively, maybe by reading books. It might sound cliché, but it genuinely helps. Once you're out of college, it is hard to find spare time. Use your free time to explore your interests because you won't have as much free time later in life. Also, stay in touch with your friends. They share the same experiences and interests as you, and it's hard to find such connections later on in life.

## Why did you decide not to pursue higher studies?

I believed that the AI Resident program offered a better alternative to a Masters degree. The field of AI is advancing rapidly, and having access to large amounts of computing power is really helpful. Working in a big company or a well-funded startup can provide better resources for this compared to a PhD program.

I also realized that a PhD is not necessary to publish good papers. I gained confidence in this by publishing papers at conferences myself and talking to people who were pursuing PhDs. Since I already had the opportunity to work at Google Brain without a PhD, I questioned the necessity of leaving that path.

## **CHITWAN WORKING IN HIS TORONTO OFFICE : AI GENERATED IMAGE MADE BY "IDEOGRAM": HIS STARTUP**



# A DAY WITH PURU!

BY MANISH KUMAR

## Prof. Purushottam Kulkarni

- Cloud computing and Virtualization
- Systems and Networking Research Group
- SynerG Lab



**Most of the CSE folks have heard you use “Systems are Vital to World Peace” in your lectures. On a daily basis, what does the phrase “World Peace” mean to you?**

Today, Intolerance and hypersensitivity is increasing all round the world causing immeasurable strife and agony.

For me, a simple version of world peace would be the motto of "Live and let live", having compassion and rational thoughts in all daily actions.

**CS professionals have the habit of playing either strategic games like chess, GO or of Computer Games like Counter Strike. What are some of the games that bring back your inner child?**

I have not had any inkling towards computer games. But I indulge in board and card games, to name a few - Uno, Monopoly, Sequence, Scotland yard & other games.

“A SIMPLE VERSION OF WORLD PEACE WOULD BE THE MOTTO OF "LIVE AND LET LIVE", HAVING COMPASSION AND RATIONAL THOUGHTS IN ALL DAILY ACTIONS”

**You have told us about the times when movie nights used to be a weekly thing in FC Kohli. We were delighted to know of a great culture back in those years. Are there any other “lesser” known facts/stories/ tales from the past you miss?**

- There used to be an annual cricket tournament between Faculty (including staff) and Students.
- Students and faculty used to hang out much more those days. (Maybe they still do!)

**How to make a good Dosa? (The CS695 lectures are full of Dosa references)**

- Soak 1 portion of urad dal & 1 tbsp methi seeds for 4 to 5 hours. Drain the water and grind into a thick batter. Soak 2 to 3 portions of rice for around 4 hours. Drain the water and grind with 1 cup of soaked poha and mix it with the urad dal batter for smooth consistency. Ferment for 6-8 hours and add salt to taste. You are ready to relish hot dosas from tawa. Don't forget the tasty sides - coconut chutney, potato bhaji or sambhar to complete the experience.
- **Shortcut:** head to any of the following — Maddu mess, Anand Bhavan, Madras Cafe, Cafe Mysore, Manis Cafe, Rama Nayak...

**What does a day in your life look like? What hobbies and activities bring you joy and help you relax?**

Most of my weekdays start around 5:45 am. I prepare my kid for school and am done with prerequisites for breakfast by 7:15 am. I indulge in a quick walk/run/swim outdoors, read the newspapers and plan the rest of my day till 8:30 am I have my breakfast with coffee and head to my office at 9 am. I leave office at 6 pm and hang out with friends till around 7 pm. I end my day spending time with family and cooking dinner till 10 pm.

Sports and cooking are my go-to activities. They give me positivity and relaxation. My minimal artistic skills were benchmarked by watercolors during COVID.

**Do you have a fitness routine? What are the sport activities you enjoy?**

I used to be playing quite a lot until a few years back - cricket, volleyball, badminton, basketball. I alternate between a quick run/swim or a game of tennis these days. I have been wanting to restart badminton for quite some time now.

**If you weren't a professor here, what would have been your alternate career?**

A tricky question. I might have been a chef, a tour guide (or someone who stays outdoors mostly) or maybe a garage mechanic.

# Shabnam Sahay

Computational biology researcher, avid Scrabble player and a skilled Bharatnatyam dancer.

BY ABHILASHA SHARMA SUMAN



## ***Looking back at your time in the insti in hindsight, what is the biggest learning that has shaped your life and career?***

Hmm, biggest learning. I think it might be that your insti experience is what you make of it to a large extent; even though you are in an institute that gives you so many opportunities, those opportunities aren't there if you don't go out and grab them. So you have to be proactive in seeking things you truly want to follow; you can't wait for peer pressure or some other external stimulus.

## ***A majority of your work has been in computational biology, which has only recently become an area of interest for students, so what was your eureka moment when you realised that you were going to pursue research in this field?***

In 11th and 12th, my fifth subject was biology, that got me interested in biology. Even after giving JEE and choosing CS going with my rank, I knew I wanted to continue with biology. So, I just started taking up bio courses in insti and during my second year, I mailed a professor asking for an internship because I wanted to try out something that would combine my degree subject and my interest subject, so to say. So, I liked that project, and I took up another one and kept taking up more courses and projects and realised that I do like this. So it was like this positive loop of reinforcement where you like something so you try it and then you like it more. It also helped me get away from the "rat race" of CS, with the likes of competitive coding and such. This was something that I enjoyed doing at my own pace.

## ***You've visited places and worked with teams across the globe. What experiences have stayed with you from each of these places?***

The first one was in NCBS Bangalore. I don't think I have found a more happy place to work in than this lab. The people there were incredibly kind; they made it fun to do science, which is one of the reasons why I continued pursuing research. The second place I went to was NUS. Singapore is called 'a city within a garden' because there is so much greenery. Nature was never out of sight. So lots and lots of trees and parks everywhere which was very cool. My roommate there was also from insti, and it was nice having someone to talk to when you come back home in a new place. Third place was Vienna last summer. The thing I took away from there was that it is important to engage in something that interests you in your daily life, like I would play the piano. Something that takes your mind off things, it's important to do that not only on the weekends but as often as you can. So yeah, it's important to learn how to be happy on your own.

## ***How did you make the choice of research vs industry?***

I think doing internships really helps you understand what you like and what you don't. My first offline internship during the winter of third year was research and I really enjoyed that. My first corporate internship was at Microsoft in the summer after my third year and that was remote. It was good, but it wasn't as intellectually engaging to me as research was; I think the positive reinforcement I got from doing research internships made me think that nothing else I do will be as enjoyable as this. So I think you have to try things out to find out, and practical experience helps you know if you don't want to do it further.



***For our readers, who have no prior experience of computational biology, what is the project that you have enjoyed working on the most and can you explain it to us like we are five?***

I'll talk about my BTP. I did it with Prof. Ganesh Viswanathan, in the chemical department. So, in a cancerous tissue, due to varying gene expression, a cell's final fate can be broadly categorised into three types- survival, death 1 or death 2. So we modelled the genes in these cancerous cells as nodes of a graph, and made the connections between the nodes such that they encoded the actual influence of corresponding genes on each other. So by simulating the state of this graph and updating it as the states of the nodes change, eventually the graph ends up in a state where no matter how you update it, the values of the nodes stay the same, that is the steady state which corresponds to the actual cell's fate-death 1, death 2 or survival. So what we wanted to see was which connections between nodes we could inhibit such that a larger percentage of cells achieve the steady state of death 2 instead of death 1.

***Do you plan to completely devote yourself to your research goals in the future?***

Yes, I do plan to go into research. It has been my goal since 2nd year. I don't know if that will change 10 years from now but at this point of time it does seem that I'll be continuing it. I applied to computational biology PhD programs this year and I'll be joining the program at Princeton later this year.

***What are some of your most cherished memories from your time here?***

That is something nice to think about. In the first year I had an amazing wing and some of those wing hangouts in the first year were great. Shoutout to the awesome friends I made in my department too. Another thing I can mention is Scrabble. There was an online Scrabble League organised in the summer of 2020, and I hadn't played Scrabble before. So I just participated in it and I got knocked out in the first round of the tournament because I was a complete noob. So then I started playing Scrabble online since there was nothing else to do sitting at home. So I guess that experience of going from a complete noob in Scrabble to someone who was able to represent IITB at inter-IIT and do well was good. Another good memory would be going to inter-IIT in my fourth year, it was a nice time with the literary club people. And I think the best memory would be the dances that I did in my eighth semester. That was, I think, no better way to have concluded my INSTI experience because I found such lovely friends there. I think most of my good memories are not related to academics, but more to the cultural activities that I did and the people I met because of them, which makes sense.

***So, in the institute, it's an environment where everyone around you is at the top of their game. So how did you manage to walk on a path that you paved instead of marching to the fife of what your peers thought or what they were doing?***

I think this has honestly been the driving force of many of my decisions: I always wanted to be different in a sense. It kind of felt very, very wrong to do what everyone else was doing. So I always felt proud of the fact that I was doing something completely of my own design; it felt like I was owning my life and that felt good to me. And when people asked me what I was doing, I could always tell them something new that they hadn't heard of. So, it was never a problem for me not to get caught up in that 'rat race', because it felt nice to not be in it.

***For the lack of a better way to ask this, how so machau?***

Well, it definitely feels nice that it appears like that but I would say it depends on what your definition of success is. I know several people in my batch who have an insanely high CPI which I don't have. I know people who dance professionally, but I'm not sure I'll ever reach that level. I think I've tried to pick two or three things that I think I will continue enjoying as I go along, and consistently involve myself in them, and that shows. In a sense, the grass is greener where you water it. I've tried to focus most of my efforts on computational biology and, to some extent, on dance and other things. It's also about getting support from advisors in terms of opportunities to showcase whatever efforts you put in. At the end of the day, see what you want to do, just pick a few things that you want to cultivate and just go after them. That should get you somewhere, I hope.

# THE FUTURE IS A.I. RIGHT ?



BY  
ABHILASHA SHARMA SUMAN

“I’d like to start this speech by thanking Horizon Institute of Technology for inviting me here and giving me a chance to interact with all of you and talk to you about the growth in AI from back when I was a youngster like you till now and where we could be going forward from here. Back when I was a college student like you, AI took off tremendously, and everyone wanted to know what the buzz was about. But as students, all we cared about was the fact that it could write our college essays for us; back then, present daily use things like self-driving cars—”

“Ma’am, do you think it’s prudent to speak of plagiarising, in front of youngsters who are starting their academic journey?” interrupted TARS.

Maya replied, “Come on, it’s humour! That’s how you engage people, T. You have come a long way, but I have yet to figure out a way to configure humour into you.”

“Well, doc, not all our dreams come true. Don’t worry though; I’ll prepare a few jokes for today’s talk”.

“Please don’t make a robot apocalypse joke.”.

“Ok, Dr.Buzzkill”.

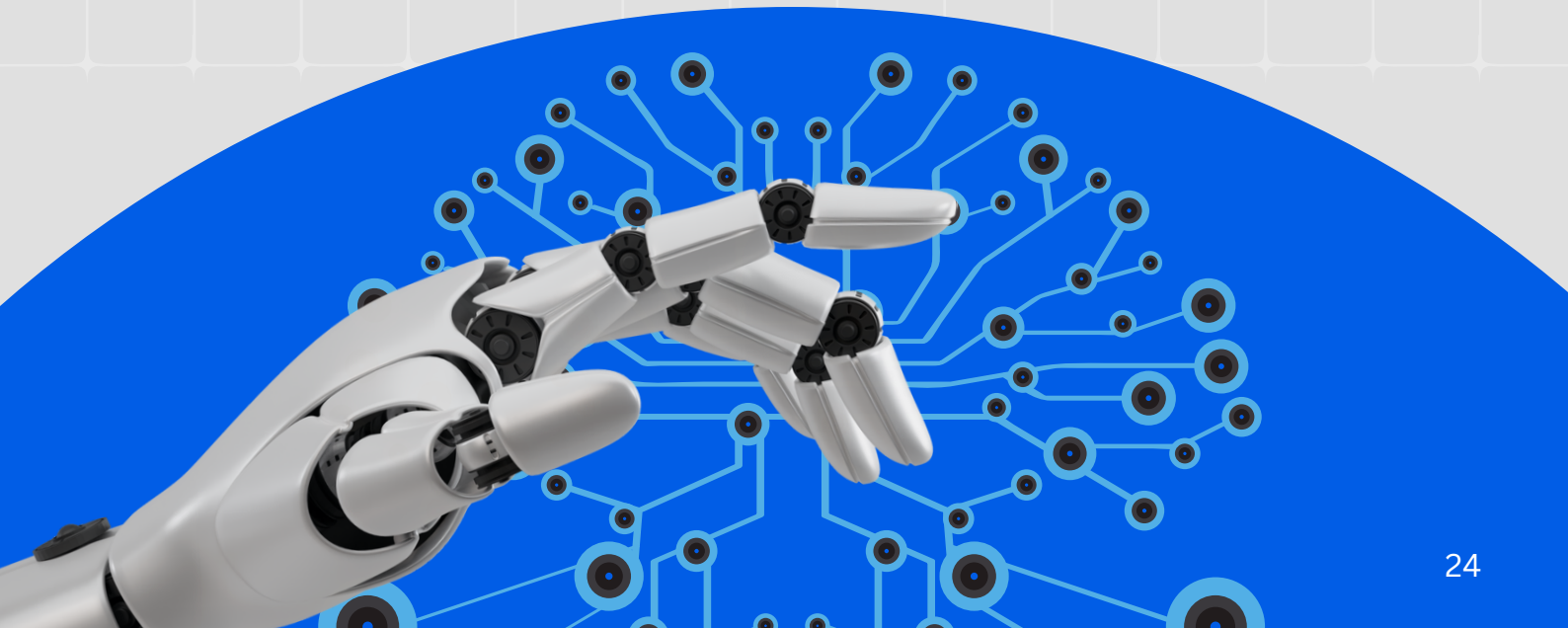
“Not funny. All right, I’m gonna leave now. Pia will be here to pick you up in 2 hours, don’t piss her off with your jokes.”

As she settled into the backseat of her car, “Good morning doc, directly to the symposium?”.

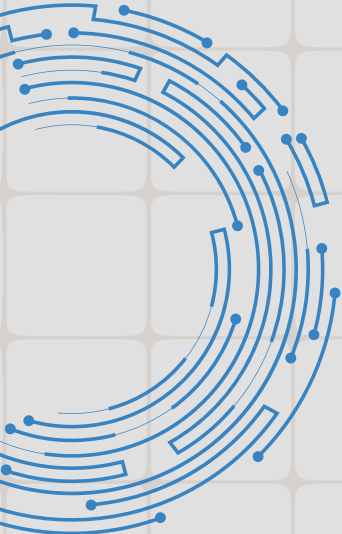
“Good morning to you too, Lex, and yes, straight to the talk. Wouldn’t wanna be late as the first speaker. A little nervous today; who knows what kind of audience kids are these days.”

“Don’t worry, doc, you’ll be ok.”

“Thanks, Lex. Really gotta go through the speech now.” The steering started turning itself, and gradually the car gained speed. Maya remembered when she was too afraid to sit in one of these self-driving vehicles when they were introduced, but now it was just a burden off her shoulders. So much had changed after all. A lot of it in the last few years.



Now, everything had changed. On the way, she saw many humans on the pavement walking alongside their robuddies. When she had just entered the field of robotics as a student, she had only seen robots in high-tech labs and sophisticated research facilities. Robots could now study subjects on your behalf so you could spend more time binging. It obviously doesn't make you smarter, but your robot is now pretty close to discovering time travel. Although they still seemed to have trouble understanding that exercise doesn't quite work for them. Cityscape was dotted with AI-driven infrastructure and smart traffic lights optimised traffic flow. The streets buzzed with life as drones zipped overhead, delivering packages and monitoring city operations. Robots had started acting in movies, and could make upto 5 movies a year, giving some serious competition to Akshay Kumar. The buildings around her seemed to pulse with life with all the vibrant displays over them. A visit to the "doctor's" was now just entering your symptoms onto a screen placed in the medical records hall of the hospital, and you would get a diagnosis along with a prescription within minutes. It was basically WebMD on steroids. Surgeries were performed entirely by robuddies. Students used AI to solve assignments and teachers used AI to grade them. AI was basically teaching itself in a loop. AI had slowly been assimilated into every single part of life.



She smiled at the thought of how she was now living in a world that, as a kid, she thought only existed in movies. Holographic communication was now the way of everyday communication; companies were run entirely by AI employees. They even made a universal cat translator, but the cats still never bothered to talk. You had a remote to control real time weather, so now it can be sunny while thunderous clouds bring down a barrage of hail. And somebody always summoned a rainbow. It was almost comi... "Woah! Lex!" "Sorry, doc," the car came to a very sudden halt. Maya looked outside the frame of her thoughts for the first time during the entire car ride. Scores of Humanoids were blocking the roads, projected in the air in front of them, "AI Rights MATTER! Give us what we deserve!" Marching side by side, shouting the slogan over and over again. These protests had been going on for weeks. All AI were advocating for intellectual property rights for themselves. Maya saw some merit in this demand, considering that the AI conceived and executed the ideas over which they were demanding rights. However, the irony of the situation wasn't lost on her either; these were all derived from already existing concepts that the AI went through and made a composite of.

She couldn't shake a sense of deep unease despite being a part of the people behind these innovations. She recalled the ethical debates and societal concerns that had accompanied the rapid advancement of AI. Questions of job displacement, privacy invasion, and algorithmic bias had loomed in society, casting clouds of gloom over the shiny facade of progress. She was brought back to the thoughts of her upcoming speech at the HIT seeing the billboards leading to the university. But what would she say now? How would she convey the complexities and nuances of a world that was changing faster than humankind could keep up with?

"We're here, doc. Oh, look, TARS. Goody!"

"Lex, there is a time and place for your sarcastic 'goody!' and it's never and nowhere. Now, gentlemen.. or gentle bots, I guess, let's be civil."

Maya entered the auditorium, ushered in by the Dean and some students. The room's energy was electric, and as she walked towards the podium, she realised that this was no ordinary speech she was going to make. The future was uncertain and times were dark, but humanity had survived Drake's coup over the UN, Taylor's fleet of space shuttles and mutant chimpanzees gone rogue from Elon's brain chip, so there was hope. Mr. Beast buying Mars turned out to be a disaster, though. Things had gone south and the once beautiful red planet was now dust circling around Jupiter, with its people floating off into deep space and surviving on space junk. But hey, the nebulae view is nice.

"I think we're gonna be okay, TARS. Let's change the world with a speech"

There was a pause.

Vani looked at the editor, but his face didn't give anything away. Finally she asked "So what do you think?"

"I mean, it's good, but maybe we can spruce this up a bit. Put it in chatgpt, ask it to ... well, work its magic and then we could see," said Harsh.

"Well, I guess that's a thing that isn't changing anytime soon."

# The Hitchhiker's Guide to doing a POR justice

BY ARHAAN AHMAD  
MANAGER, KRITTIKA

I spent most of my second semester getting rejected by clubs and tech teams. If there was some kind of record of messing up interviews, pretty sure I broke it. Multiple people asked me what the point of going through this ordeal was again and again, and if I'm being totally honest, so was I. I finally struck home at Krittika, the Astronomy Club of IIT Bombay, where I spent my second year as a volunteer and third year as the manager. As I look back on my two years as a part of Krittika, I see that there are multiple things I learned and cherished that I would not give up on anything else college life has to offer. Let me try to convince you of the right reasons you should consider becoming associated with some or the other student body in the institute, something that has always been sidelined in CSE circles. I have seen tech clubs from a very close perspective, but a lot of these apply to some tech teams and some other clubs in the institute as well. You can take various paths in your insti life; this article is about the one I took and how it turned out.

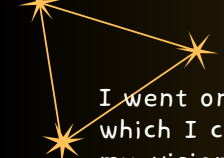
First, no matter what anyone tells you, you are not supposed to put any extracurricular activity above your academics. The regrets you will have later are just not worth it. However, acads should not become your excuse for not exploring other things in college. We have a bunch of student clubs and tech teams catering to a wide set of interests, with surprisingly few people from our department in them. This is primarily because of two reasons:

★ People don't apply because they're not sure if they'll be able to manage it with academics and if it will be useful to them. As already mentioned, I do hold academics in high regard, but if you manage your time well, it is very possible to pursue other activities seriously. Doing such activities helps develop better social and soft skills and make new friends who have interests similar to yours. I have built some pretty close friendships in Krittika and ITC. This is not a plug for any particular club or council, all places have their different cultures and pros and cons, and the place where you fit in might be different from the next person.

★ A lot of the communities believe that CSE people will ditch their work later when their academics get hard. I have also been guilty of judging CSE candidates harshly. Sadly, this comes from past experiences, and you need to make sure you don't add to that stereotype. Before applying to any place, make sure you are not over-committing to things. Talk to previous members beforehand and figure out if you really want to spend your time there. You might need to do ★ little convincing in the interview about why you think you will be able to handle everything and why joining a particular community matters to you. Also, be prepared to face some failures..

In tech clubs, we call the second-year position a "convener". Everyone has slightly different expectations, but one common theme is that you should be passionate about the field and to learn more about it. We value clear communication when you are busy and cannot do assigned work on time. Everybody understands if you need to take some time off periodically to focus on acads, but what creates problems is if this gets way too frequent and starts interfering with the overall dynamics. Even in that case, clear communication with your managers and the rest of the team is key. The time commitment is different for different places, and you should be clear about that before applying.





I went on to become the manager of the club in my 3rd year. It was an incredible experience about which I could write multiple articles. The major difference is that as a manager, I could implement my vision for the club. I was also responsible for the proper working of everything, which is a daunting task for a club with a rich history like Krittika. The shift in perspective needed does not happen overnight. Most places facilitate this through a rigorous process, starting with extensive groundwork, where you talk to a whole lot of seniors and absorb their teachings. The process opens your mind to understanding the second-level effects of your actions. This is followed by making a manifesto, which is a document containing all the major things you wish to implement, followed by a soapbox where everyone who cares about the club can come and ask you questions about your initiatives. The entire process lasts for about 30-45 days. For me (and most other people I know), these days are when you grow tremendously and become a slightly different person.

Being a manager became a much bigger time commitment than what I had in my second year, but my impact and learnings also increased exponentially. The independence to implement anything I want drives me crazy, and the kick you get when you see one of your initiatives taking form is absolutely phenomenal. You also build your team and start feeling low-key like a parent. This might seem funny, but having people looking up to you makes you want to do everything better.

> Author moments before adding his conveners to the WhatsApp group



I am not ready for kids 8:54 AM ✓✓



I also became a part of the awesome Institute Technical Council. I learnt to do real collaborative work while learning from some amazing peers in the council. Two major things I led were coordinating Learners' Space and handling specific logistics of Inter IIT Tech. Both initiatives allowed me to impact a good number of people in the institute. The council allowed me to work on initiatives that impacted a much larger community than what my club catered to.

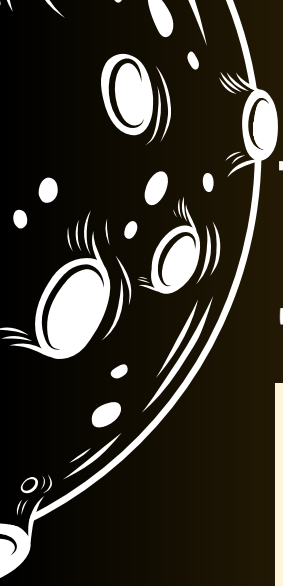
The reason I am putting myself out here and writing this article is because most of us undervalue the kind of skills and experiences you gain from working in a club. It is not another addition to your resume or another thing to speak about in an interview. Start really caring about your work, and you will learn skills that are valued in every facet of life. For me, one major gain was public speaking. In my first year, I used to be this kid who was useless at speaking in front of a crowd (and still am to a smaller extent). The public speaking opportunities I got have made me much more confident in dealing with such situations. Working in a team requires you to communicate properly with others, and there are also ample public speaking opportunities. In Krittika, I spent almost every other weekend of the spring semester interacting with the crowd at my telescope. The various occasions to talk to people increased my overall confidence in getting words from my mind to the outside world. I have learnt to believe that there is a confident speaker inside all of us, and it takes some practice to bring it out.

I have worked on organising institute-wide events, lots of stargazing sessions, a bunch of talks and movie screenings. At the same time, I have designed posters and invitation cards on Canva, negotiated with people, bargained with t-shirt vendors and whatnot. These big and little things have shaped me as a person. In my 3rd year, I realised how exciting moving out of my comfort zone felt, and I started saying yes to more things. I have been a soldering mentor in XLR8 mentor, handled the organisation of the Product Management GC, and volunteered at an event explaining circuits to school kids. Once, I went to multiple schools uninvited to publicise an event to them (long story). Some things went right, some went wrong, and both outcomes bring in their different set of learnings. I have always loved the freedom to make mistakes and, more so, the freedom to try to mend them which isn't always there in an academic setting.

It's funny thinking how all of these experiences hinged on my decision to associate with Krittika in my second year. I am sure a lot of people across various clubs and other bodies resonate with my feelings. If the things I mentioned are important to you, you should definitely try your hand at it. Or try a sport, or dramatics, or singing, or dancing, or aeromodelling or building a Mars rover. There are infi opportunities in college that get overlooked. Experiences that could change your life get lost in the endless pit that is webmail, be on the lookout for them.

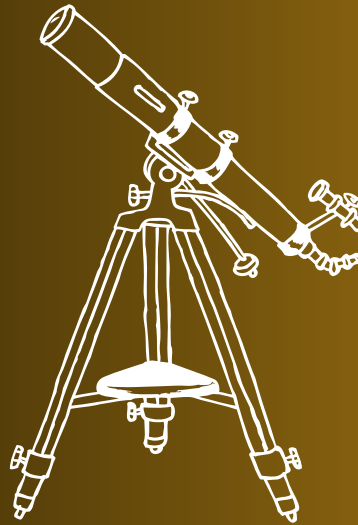


*Sometimes you just need to look up at the stars and take a leap of faith.*



# THROUGH THE LENS

## THE ORION NEBULA



## PLEIADES



## THE LEO TRIPLETS

The Leo Triplet is a small group of galaxies about 35 million light-years away in the constellation Leo. This galaxy group consists of the spiral galaxies M65, M66, and NGC 3628

## COLLIDING GALAXIES - M51 AND NGC5195

The Whirlpool Galaxy, also known as M51 or NGC 5194, is located about 23 million light-years away in the constellation Canes Venatici. It is known for its striking spiral arms and its companion galaxy NGC5195

In fact these two galaxies are colliding at this very moment.



## IMAGE ACQUISITION AND PROCESSING

The majority of these images are captured utilizing a DSLR camera affixed to a telescope, which is precisely aimed at the intended celestial object. To counteract the rotational motion of the Earth, the telescope is positioned atop a motorized mount. Consequently, the object appears stationary relative to the telescope, allowing for the acquisition of long-exposure shots, typically spanning 20 to 30 seconds each, over a duration ranging from 30 minutes to several hours. Subsequently, these individual exposures are meticulously stacked and undergo post-processing procedures to yield a refined final image.

Image Credits:

Orion, Pleiades, Leo - Ravi Kumar

Whirlpool - Anvit Navin Khade

# A Note from the Editor

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*Dear Reader,*

This magazine was a labor of love from the many people involved - the editors who tried their best to bring novel ideas to the spotlight, and the designers who helped convey their vision. We all hope you enjoyed reading through it all - across multiple genres of personal pieces, geeky case studies, insightful interviews - as much as we enjoyed bringing it to you.

This brings us here, to the end of this magazine. There's no more articles for your edification or entertainment this year. That is not entirely a bad thing, there will always be ideas the current team couldn't think of or thought of but didn't have the bandwidth to bring them to life. When I set out to work in this role, I thought about who I was writing for. It isn't exactly the large thousand-strong CSE audience. It also isn't exactly for myself. It is for those of you who liked reading this and have ideas of your own that you want to get through to the next edition. I wanted to be a part of the magazine when I first read it as a fresher, and I wanted to create something better. I hope I have succeeded in my attempt, and hopefully sparked such an interest in someone who will worry little about the precedent and take the editorial work to new heights.

I used to tell myself I wouldn't have applied if I didn't think I could make the whole magazine myself. I have never been more happy to be so utterly wrong. I am so grateful for the contributions of every single member involved, without whom it just wouldn't be as good. I have lots of appreciation for our design maestros Anushka, Chaitra and Parth for making this appealing enough for my inner child to read in one sitting.

And finally, I am thankful to you, the reader, for taking the time to go through our creation. We hope it was well worth your time.

Please send your feedback, appreciation or criticism to [editor@cse.iitb.ac.in](mailto:editor@cse.iitb.ac.in). I look forward to hearing from you.

Signing off,

*Harsh Poonia*

# The BitStream '23-24 Team

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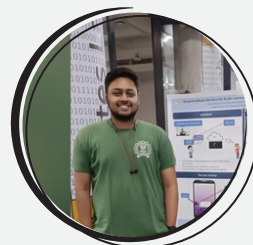
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